UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/665,267	09/17/2003	Rene George	MAT-4	7128

21833 7590 11/27/2006

PRITZKAU PATENT GROUP, LLC
993 GAPTER ROAD
BOULDER, CO 80303

EXAMINER	
RODGERS, COLLEEN E	
ART UNIT	**PAPER NUMBER**
2813	

DATE MAILED: 11/27/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/665,267	GEORGE ET AL.	
	Examiner	Art Unit	
	Colleen E. Rodgers	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 July 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-4,6-23 and 25-87* is/are pending in the application.

4a) Of the above claim(s) *37-66,69-74 and 77-80* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4,6-23,25-36,67,68,75,76 and 81-87* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☒ Claim(s) *83-87* are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. This Office Action responds to the Amendment dated 20 July 2006. By this amendment, claims 1, 20, 67, 68, 75 and 76 are amended and claims 83-87 are new. Claims 1-4, 6-23 and 25-87 are pending.

Claim Objections

2. Claims 6 and 25 objected to because of the following informalities: each depends from a canceled claim. Appropriate correction is required. For purposes of this Office Action, it is assumed that claim 6 is intended to depend from claim 1 and claim 25 is intended to depend from claim 20.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 1-4, 6-13, 16-23, 25-36, 67, 68, 75, 76 and 81-85 rejected under 35 U.S.C. 102(e) as being anticipated by **Savas et al** (USPN 6,805,139).

Regarding claims 1 and 20, **Savas et al** disclose a plasma reactor system and a method of using said plasma reactor system, for use in removing an implant crust **105** that is formed as an outermost layer of a photoresist pattern **104** that is supported by a treatment object **101**, said implant

crust being formed responsive to exposure of the treatment object to a high dose ion implant which introduces an implanted dopant into the treatment object as well as into the photoresist, thereby producing said implant crust [see col. 3, lines 7-11], comprising:

a treatment chamber **402** within which a plasma is generated using a hydrocarbon gas in combination with an oxygen gas [see Fig. 6, "Embodiment #1"; see also col. 15, lines 53-58] in a way which subjects the implant crust to the plasma to remove the implant crust, formed responsive to introduction of said implanted dopant , said plasma being free of halogens, at least to an approximation, to remove the implant crust without the use of introduced halogens.

Regarding claims 2 and 21, **Savas et al** disclose the system and method of claims 1 and 20, respectively, furthermore wherein said hydrocarbon gas produces low molecular weight radicals in said plasma [see col. 21, lines 16-19].

Regarding claims 3, 4, 22 and 23, **Savas et al** disclose the system and method of claims 2 and 21, respectively, furthermore wherein said low molecular weight radicals include a molecular weight of less than approximately 30 [see Fig. 6, "Embodiment #1"; see also col. 15, lines 53-58, wherein a methane or methanol source gas would produce CH_2^+ radicals, which have a molecular weight of approximately 14].

Regarding claims 6, 7, 25 and 26, **Savas et al** disclose the system and method of claims 1 and 20, respectively, furthermore wherein said implant crust **105** overlies an unaltered region of an original photoresist layer **104** and said plasma formed using said hydrocarbon gas in combination with oxygen is used to simultaneously remove said unaltered region of photoresist and said crust [see col. 3, lines 25-29].

Regarding claims 8 and 27, **Savas et al** disclose the system and method of claims 7 and 26, respectively, furthermore wherein said plasma is generated with downstream plasma generation means [see Fig. 4, wherein the plasma is supplied via external gas source **403**].

Regarding claims 9 and 28, **Savas et al** disclose the system and method of claims 1 and 20, respectively, furthermore wherein the treatment object **101** is a semiconductor wafer [see col. 3, lines 4-5].

Regarding claims 10, 12, 29 and 31, **Savas et al** disclose the system and method of claims 1 and 20, respectively, furthermore wherein hydrocarbon gas is in a range from approximately 15% to 85% of an overall mixture with the oxygen gas, and wherein 75% methane and 25% oxygen may form the overall gas mixture [see col. 21, lines 16-19, wherein oxygen is less than 50% of the total gas flow rate].

Regarding claims 11 and 30, **Savas et al** disclose the system and method of claims 1 and 20, respectively, furthermore wherein said hydrocarbon gas is methane [see Fig. 6, "Embodiment #1"; see also col. 15, lines 53-58].

Regarding claims 13, 32 and 33, **Savas et al** disclose the system and method of claims 1 and 20, respectively, furthermore including an inductive coil for inducing power into the plasma at a power level of at least about 200 watts [see col. 10, lines 25-27] and up to 2000 watts is disclosed [see col. 17, lines 2-5], which overlaps at least 200 watts (claim 13), at least 500 watts (claim 32) and from approximately 500 to 5000 watts (claim 33).

Regarding claim 16, **Savas et al** disclose the system of claim 1, furthermore including a microwave plasma source for generating said plasma [see col. 3, lines 39-43].

Regarding claims 17-19 and 34-36, **Savas et al** disclose the system and method of claims 1 and 20, respectively, furthermore wherein said treatment chamber is at a pressure from about 300

mTorr to 10 Torr, depending on the plasma source employed [see col. 8, lines 30-34], which overlaps 0.5-15 Torr (claims 17 and 34), approximately 3 Torr (claims 18 and 35) and approximately 1 Torr (claims 19 and 36).

Regarding claims 67 and 68, **Savas et al** disclose a plasma reactor system and a method of using said plasma reactor system, for use in removing an implant crust **105** that is formed as an outermost layer of a photoresist pattern **104** that is supported by a treatment object **101**, said implant crust being formed responsive to exposure of the treatment object to a high dose ion implant which introduces an implanted dopant into the treatment object as well as into the photoresist, thereby producing said implant crust [see col. 3, lines 7-11], comprising:

a treatment chamber **402** within which a plasma is generated using a hydrocarbon gas in combination with an oxygen gas [see Fig. 6, "Embodiment #1"; see also col. 15, lines 53-58] in a way which produces at least one of CH_2 and CH_3 radicals in said plasma [see Fig. 6, "Embodiment #1"; see also col. 15, lines 53-58, wherein a methane or methanol source gas would produce CH_2^+ radicals] to subject the implant crust to the plasma to remove the implant crust, previously formed responsive to introduction of said implanted dopant , said plasma being free of halogens, at least to an approximation, to remove the implant crust without the use of introduced halogens.

Regarding claims 75 and 76, **Savas et al** disclose a plasma reactor system and a method of using said plasma reactor system, configured to remove a process residue that is formed on the treatment object **101**, at least in part, as a result of removing an ion-implanted photoresist **105** from the treatment object, said ion-implanted photoresist crust being formed responsive to exposure of the treatment object to a high dose ion implant which introduces an implanted dopant into the treatment object as well as into the photoresist **104**, thereby producing said implant crust [see col. 3, lines 7-11], comprising:

a treatment chamber **402** within which a plasma is generated using a hydrocarbon gas in combination with an oxygen gas [see Fig. 6, "Embodiment #1"; see also col. 15, lines 53-58] in a way which subjects the process residue including the implant dopant species to the plasma to remove the process residue including said implanted dopant therein, said plasma being free of halogens, at least to an approximation, to remove the process residue containing the dopant species without the use of halogens.

Regarding claims 81 and 82, **Savas et al** disclose the system and method of claims 1 and 20, respectively, furthermore wherein hydrocarbon gas is in a range from approximately 15% to 85% of an overall mixture with the oxygen gas, and wherein 75% methane and 25% oxygen may form the overall gas mixture [see col. 21, lines 16-19, wherein oxygen is less than 50% of the total gas flow rate, which is exemplary and non-limiting].

Regarding claim 83, **Savas et al** disclose a method for treating a workpiece **101**, comprising:

forming a patterned layer of photoresist **104** on a device side of the workpiece;

exposing the photoresist and a selected region of the workpiece to a high dose ion implantation to implant a dopant species into the selected region of the workpiece as well as into said photoresist to produce an implant crust **105** as an outer layer of the photoresist in an interaction responsive to implantation of said dopant species [see col. 3, lines 7-11];

generating a plasma using a hydrocarbon gas in combination with oxygen gas such that the plasma is halogen free, at least to an approximation [see Fig. 6, "Embodiment #1"; see also col. 15, lines 53-58]; and

exposing the implant crust to the plasma to remove the implant crust, previously produced by introduction of said implanted dopant.

Regarding claim 84, **Savas et al** disclose the method of claim 83, furthermore wherein the implant species is arsenic, phosphorus or boron [see col. 11, lines 52-60; also col. 12, lines 28-32].

Regarding claim 85, **Savas et al** disclose the method of claim 83, furthermore including exposing said workpiece with an ion energy ranging from 5 KeV to 500 KeV (specifically 80 KeV if the ion is arsenic and 120 KeV if the ion is phosphorus) and an implant ion dose greater than 1.0 x 10^{15} ions/cm^2 (specifically 1.5 x 10^{16} ions/cm^2 if the ion is arsenic and 5 x 10^{15} ions/cm^2 if the ion is phosphorus) [see col. 11, lines 52-60].

Regarding claim 86, **Savas et al** disclose the method of claim 83, furthermore wherein said hydrocarbon gas is methane [see Fig. 6, "Embodiment #1"; see also col. 15, lines 53-58].

Regarding claim 87, **Savas et al** disclose the method of claim 83, furthermore wherein hydrocarbon gas is in a range from approximately 15% to 85% of an overall mixture with the oxygen gas, and wherein 75% methane and 25% oxygen may form the overall gas mixture [see col. 21, lines 16-19, wherein oxygen is less than 50% of the total gas flow rate, which is exemplary and non-limiting].

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Savas et al** (USPN 6,805,139). **Savas et al** disclose the system of claim 1, including an inductive coil for inducing

power into the plasma at a power level of up to 2,000 W. **Savas et al** do not disclose wherein the power level may be as high as 3,000 W. However, these claims are *prima facie* obvious without a showing that the claimed ranges achieve unexpected results relative to the prior art range. *In re Woodruff*, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also *In re Huang*, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996) (claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also *In re Boesch*, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill of art) and *In re Aller*, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art in general conditions is obvious). In this case, there exists no evidence of record that the power to which the plasma is subjected provides unexpected results in the workpiece produced. One of ordinary skill in the art would be motivated to optimize the power to which the plasma is subjected to provide for processing limitations.

7. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Savas et al** (USPN 6,805,139) in view of **Fukuyama et al** (USPN 5,770,100). **Savas et al** disclose the system of claim 1. **Savas et al** do not disclose a parallel plate reactor for plasma generation. **Fukuyama et al** disclose a parallel plate reactor for a similar process. It would have been obvious to one of ordinary skill in the art at the time of invention to employ a parallel plate reactor for the plasma generation because **Fukuyama et al** teach that it is one of several art-recognized methods for generating a plasma useful in this sort of process [see col. 7, lines 48-53].

Response to Arguments

8. Applicant's arguments with respect to claims 1-4, 6-23, 25-36, 67, 68, 75, 76, 81 and 82 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Colleen E. Rodgers whose telephone number is (571) 272-8603. The examiner can normally be reached on Monday through Friday, 9:00 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

CER

CARL WHITEHEAD, JR.
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800